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capable of turning out six hundred maps per hour, are continually at work. Each year there are printed and distributed 1,200,000 maps, about as many as the Coast and Geodetic Survey has published since it came into existence. At Southampton, where the office of the English Ordnance Survey is located, the personnel consists of about nine hundred persons, of which probably one hundred belong to the army. The map printing establishment has even greater capacity than that at Paris, 3,000,000 maps being delivered annually. Although the great trigonometric work may be considered as finished in England, nevertheless, the topographic work goes on, and the effort is made to cover the whole kingdom once in twenty years with a new map on a scale of 1/2,500, and once in fifteen years with one on 1/10,000. Of course, the latter is made from the former by making blue prints, tracing in black the detail required, and photographing again, which leaves out everything in blue on the original sheet.

E. D. PRESTON,

Delegate on the part of the United States.

U. S. COAST AND GEODETIC SURVEY.

THE ANNUAL REPORT OF THE SECRETARY
OF AGRICULTURE.

THE Report of the Secretary of Agriculture for 1898, just issued, is of interest as showing the growth of the technical and scientific work of the Department. This national agency for the promotion of agriculture now consists of two bureaus, two offices and fourteen divisions, most of which are engaged in scientific inquiries. A few of the more salient features of the work of the Department during the last year may serve to indicate the lines in which it is making progress.

The Weather Bureau has greatly increased the efficiency of its forecast service by the establishment of a considerable number of observation stations in the West In-

dies and additional stations in the more arid regions of the West. A climate and crop service has also been begun in Alaska.

The Bureau of Animal Industry has had great success in its experiments for the repression of hog cholera by the use of specially prepared serum. The experiments in dipping cattle to kill the ticks which cause Texas fever have also been successfully conducted on a large scale.

The work of the Division of Chemistry on the composition and adulteration of foods and on sugar beets has been quite extensive. Studies of typical soils in the vegetation house by the Division have shown that "Meteoric influences other than those relating to precipitation have a great influence on crop production. The solar influences are evidently of great importance, and the distribution of solar heat is a factor not to be neglected."

Among the more important investigations of the Division of Entomology have been those on the Morelos orange fruit worm, the Mexican cotton-boll weevil, chinch bug, Hessian fly and San José scale.

The Biological Survey is energetically pushing its researches on the life zones of the United States.

The Division of Vegetable Physiology and Pathology has made interesting investigations relative to increasing the sugar and starch producing power of plants and the effect of soil foods on their growth and productiveness. A large amount of hybridizing has also been done with oranges and other citrus fruits, pineapples, pears, wheat and other crops.

Our knowledge of the native forage plants of the Great West has been considerably enlarged by the recent work of the Division of Agrostology, which has added nearly 3,000 sheets of specimens to the National Herbarium during the year.

The Division of Soils has perfected and cheapened its electrical apparatus for the

determination of soil moisture and has begun the detailed mapping of soil areas adapted to different crops.

The Division of Forestry has been reorganized under its new Chief and will devote itself more largely to experiments on a relatively large scale in the economic management of forest lands and the reforestation of the Western plains.

Besides its work on the National Herbarium, the Division of Botany is enlarging its studies of seeds and has recently been charged with the supervision of seed and plant introduction from foreign countries, for which the Department already has several agents at work in different countries.

The method of crop reporting has been improved under the direction of the present Chief of the Division of Statistics, and special economic investigations, such as those relating to the cost of producing a bale of cotton and the world's consumption of wheat, have been undertaken.

The Section of Foreign Markets has issued timely and valuable reports on the commerce of Hawaii, Spain and Puerto Rico.

The Office of Experiment Stations, besides general supervision of the expenditures of the 53 experiment stations, preparation of the Experiment Station Record and other publications based on the work of the stations, has had the direction of special investigations on the agricultural capabilities of Alaska and on the food and nutrition of man. Recently this office has also been charged with investigations on irrigation, which are to be carried on in cooperation with the experiment stations and State engineers in the irrigated region. In connection with the nutrition investigations, the Atwater-Rosa respiration calorimeter has been so far perfected that "not only the nutritive value of the food consumed, but also its relation to the heat and energy evolved by the human body during periods of rest and

work have been measured with a completeness and accuracy hitherto unknown."

The examination of the work and expenditures of the agricultural experiment stations by the Office of Experiment Stations during the past year has shown that these institutions are, as a rule, working more thoroughly and efficiently than ever before for the benefit of American agriculture. More than six hundred persons are employed in the work of administration and inquiry. About four hundred reports and bulletins were issued by the stations in 1897, which were directly distributed to over half a million addresses, besides being widely reproduced in the agricultural and county papers. The appropriation of \$720,000 from the National Treasury for the support of the stations was supplemented by State funds aggregating over \$400,000.

"The need and value of scientific researches on behalf of agriculture are now very clearly understood, and the number and importance of institutions organized for this work are constantly increasing in all parts of the world. Nowhere has so comprehensive and efficient a system of experiment stations been established as in the United States. In the scope and amount of their operations, and in the thoroughness with which the useful information they obtain is disseminated among the farmers, our stations are unsurpassed. During the ten years which have elapsed since the Hatch Act went into effect a very large amount of accurate information of direct practical benefit to our farmers has been published by the stations. Not only have the numerous bulletins and reports of the stations been freely distributed in all parts of the country, but many valuable books largely based on the work of the stations have been written for the farmer's use, while the agricultural press has busily collated and disseminated a vast amount of information directly relating to the work

of the stations or supplementary to it. The contrast between the correct information regarding the principles and practices of his art easily obtainable by the farmer of to-day and that available for his predecessor a generation ago is very wide and striking."

The Secretary strongly urges that the stations should more fully devote themselves to original investigation in behalf of agriculture.

"Political considerations should have no place in the choice and retention of station officers; college duties should not be allowed to encroach upon the time set apart for original investigation, and the compilation of old information should always be made secondary in the acquirement of new knowledge.

"The stations are not the only means for the education of the farmer. Agricultural colleges, farmers' institutes, boards of agriculture and various other agencies have been established to instruct the farmer regarding the present status of agricultural science as applied to his art. It is the business of the experiment stations, on the other hand, to advance knowledge of the facts and principles underlying successful agriculture and to teach the farmer new truths made known by their investigations. The Act of Congress creating the stations clearly defines their functions to be the making and publishing of original investigations. Wherever a station has neglected this and merely endeavored to educate the farmer we find a weak station, and wherever a station has earnestly devoted itself to original investigations we find a strong station."

The Secretary also heartily commends the movement to secure the introduction of nature-teaching into the common schools, and favors the providing of special privileges for graduate students in the scientific divisions of the Department.

In general, the tone of the Secretary's Report is very encouraging to the scientific workers of the Department, for, while he strongly insists on the necessity of bending every energy to the securing of results of wide practical application, it is clear that he believes that this end can be most certainly and effectively reached by broadening and strengthening the scientific researches of the Department.

The following schedule indicates in brief the present development of the Department as an agency for research and education in agricultural science.

THE DEPARTMENT AS AN AGENCY FOR RE-
SEARCH AND EDUCATION IN AGRI-
CULTURAL SCIENCE.

Weather Bureau : Researches in climatology and meteorology.

Bureau of Animal Industry : Researches on animal diseases, including chemical, bacteriological and zoological investigations.

Division of Statistics : Collection and study of agricultural statistics.

Division of Entomology : Researches on life history and geographic distribution of insects and on means of repression of injurious insects.

Division of Chemistry : Researches on soils, fertilizers, foods, sugar-producing plants, methods of analysis, etc.

Division of Botany : Researches on the natural history, geographic distribution and utilization of plants, special studies on seeds and on poisonous and medicinal properties of plants, and collection of seeds and plants from foreign countries.

Division of Forestry : Researches on the natural history, biology and utilization of forests and forest trees and on timber physics.

Division of Biological Survey : Researches on the geographic distribution of plants and animals and on food habits of birds and mammals.

Division of Pomology : Studies on varieties of fruits and nuts.

Division of Vegetable Physiology and Pathology : Researches on the physiology and diseases of plants.

Division of Soils : Researches in agricultural physics, especially on the physical properties, moisture, temperature, etc., of soils.

Division of Agrostology : Researches on natural history, geographical distribution, and utilization of grasses and forage plants.

Office of Road Inquiry: Experiments in road engineering.

Office of Experiment Stations: Collection and dissemination of information regarding agricultural education and research in the United States and other countries. Supervision of coöperative investigations on the food and nutrition of man and on irrigation. Investigations on the agriculture of Alaska.

The Library: Contains 63,144 volumes, largely on agriculture and agricultural science. The library is engaged in the preparation of bibliographies of subjects in agriculture and agricultural science.

Publications: During the year ended June 30, 1898, the Department issued 501 bulletins and reports, the total number of copies being 6,280,365, exclusive of the Yearbook, which has an edition of 500,000 copies, and also of the publications of the Weather Bureau.

A. C. TRUE.

THE BREEDING OF ANIMALS AT WOODS
HOLL DURING THE MONTHS OF JUNE,
JULY AND AUGUST.

DURING the month of June the temperature of the water continues the regular increase which begins on the first of April, and toward the end of the month reaches the temperature of 65° F. During July of the present year it fluctuated between 66° F. and 71° F., and during August it frequently registered 72° F.

With the increased temperature of the month of June there is a corresponding increase in the number of breeding animals; indeed, this month indicates the culminating point of reproductive activity of marine organisms at Woods Holl. The months of July and August are characterized by a constantly decreasing number of breeding animals, though the high temperature of the water is conducive to the rapid growth of innumerable larvæ.

Vertebrates.—Breeding lampreys have been taken at East Taunton as late as June 17, and the eggs hatch in from eleven to fourteen days. The smooth dog-fish, *Galeus canis*, frequently gives birth to 'pups' while confined in the 'fish cars' during this month. These young, beautifully marked,

swim about with their parents, and do not seriously suffer from their restricted quarters. The fishermen say that the 'smooth dog' has two broods, and the observations made at the laboratories would indicate that this view is correct. The first brood is generally dropped during the early part of June, though during the latter part of the month a few females are often found with fully developed young. It is probable that, as soon as the young are born, mature eggs leave the ovary and pass into the oviduct, where they become fertilized. Professor W. A. Locy has removed eggs from the oviduct, which were in segmentation stages, from as early as June 22 to as late as July 4. Through the early part of July the embryos are small, but during August only advanced stages are found. The second brood may be dropped as early as August 10th.

The belief that the females after giving birth to their first brood immediately breed again is supported by Dr. Ayers, who has noted that there are congested placental spots on the uterine walls of individuals, the oviducts of which contain active spermatozoa, and Dr. Locy has noted that the ovaries contain certain large ova during June, whereas they contain only smaller eggs after the early part of July. No individual, however, is actually known to have given birth to two broods in a single summer.

The sand shark, *Carcharias littoralis*, the most common shark at Woods Holl during the summer, so far as I know, has never been taken during the breeding season, all the individuals being apparently immature. The spiny dog-fish, *Squalus acanthias*, though at times abundant during the early spring, has not been taken in sufficient numbers during recent summers to be of special value. Those desirous of collecting embryological material of this species have generally gone to North Truro, Province-